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GEOLOGY.—*A Review of recent reports on investigations made in Florida on Pleistocene geology and paleontology.*[1] OLIVER P. HAY, Washington, D. C.

Recently the writer presented a paper[2] which dealt with the geological age of the vertebrate fossils reported as found by Professor F. B. Loomis and Dr. J. W. Gidley, mostly at Melbourne, Florida. Since the presentation of that article other reports on investigations at Melbourne, Vero, and one or two other localities have been published. One is a joint report[3] by Gidley and Loomis on their work done in 1925. Another is an individual statement made[4] by Prof. Loomis. A third report is that made[5] by Dr. Wythe Cooke, who was assigned by the U. S. Geological Survey as associate with Dr. Gidley in the investigation made in 1926. Dr. Gidley's report for work done in 1926 has not yet appeared. In the statements published the writers describe the geological features of the various localities, note in a general way the fossils found, and announce the conclusions reached concerning the age of the deposits and fossil animals and that of the human remains encountered.

It is not wholly a pleasant task to take up this subject again and to employ the necessary repetitions. In various respects the reports are disappointing. On the geological side, one might expect to find a sketch map showing the topography of the region examined at Melbourne and the locations of the excavations made. From the paleontologists the public might have expected a more satisfactory statement of the species of vertebrate fossils found. As it is, only a few

[1] Received February 3, 1927.
[2] This JOURNAL, **16**: 387–392. 1926.
[3] Amer. Journ. Sci. (5), **12**: 254–264. 1926.
[4] Nat. Hist., **26**: 260–262. 1926.
[5] Amer. Journ. Sci. (5), **12**: 441–452. 1926.

are mentioned and these only incidentally. Since the close of the work of 1926 nearly a year has passed and in this interval the fossils then collected might have been studied and their meaning determined. Dr. Cooke mentioned some fossils under names based on identifications made in the field by Dr. Gidley and often followed by marks of query. At present one can not be certain just what species were collected by the various expeditions nor in exactly what horizons they occurred.

The writer will deal first with Dr. Cooke's report. With the details of this, little fault is found. Dr. Cooke was bound within narrow limits by his acceptance of the theory of marine origin of the terraces of the coastal plain and of the times of their formation. When he argues that, if those terraces were formed at long intervals during the Pleistocene, the lowest one is of rather recent date, he is right. If this were granted, it would follow that any deposits and fossils laid down on this terrace are young.

In one of his papers the writer, in discussing the coastal plain terraces, showed[6] that if they were of marine origin there must have been buried in each of them abundant remains of marine organisms, especially of mollusks. So far as known, such remains are wholly lacking, except in the lowest levels of the lowest terrace. When I inquire what agency has been effective in removing the vertebrate bones and teeth and the molluscan shells I am told that it has been done by carbonated rain water. This theory appears reasonable until it has been tested. Over large areas of Florida the shell bed of the Anastasia marl has been exposed long ages at or near the surface and it remains there. Rain water has not dissolved out the shells of mollusks and the bones of whales buried in the Pleistocene clays around Lake Champlain and along St. Lawrence and Ottawa rivers. Along Mississippi and Missouri rivers are thick deposits of loess, a formation permitting the easy passage of meteoric water. In many localities numerous species of delicate land snails remaining unchanged have been collected from it.

If we carry our investigations into Europe, where the Pleistocene has been more thoroughly studied than in America, we soon learn that around nearly all the countries bordered by seas there are marine deposits of Pleistocene age, often in the form of terraces. In the interior, beyond the reach of marine waters, along the rivers and lakes, both in glaciated and unglaciated regions, are terraces, sometimes as

[6] This JOURNAL, 14: 255. 1924.

many as four or more, and belonging some to early and some to late Pleistocene times. These terraces show not only by their physiographic form but more convincingly by the inclusion of fossils that they were laid down under waters, marine or fresh, during times of subsidence. Believers in the marine origin of our coastal plain terraces ought to procure Haug's *Traité de Géologie* and read his remarks on the Quaternary. They might then wonder what has been the matter with the rain water which has fallen on European soils for the last half million years that the abundant fossils have not been dissolved out. An entire page could be filled by only the record of localities where fossils, especially mollusks, marine, freshwater, and terrestrial, are found.

The writer believes that he is justified in saying that the reason why no marine fossils are found on our coastal plain terraces is that marine waters have had nothing to do with those terraces. Probably not since the Pliocene has our coast, south of New Jersey, been submerged more than a very few feet. North of New Jersey there was, during at least the last glacial stage, considerable subsidence; and this is shown by an abundance of marine fossils.

There appears to be sufficient evidence that during the latter part of the Pliocene and during the earlier part of the Pleistocene the whole of this continent stood at a much higher level than it now does. It seems not improbable that the eastern border of the continental shelf was near sea-level. It was probably during this time of high elevation that the swift and swollen streams excavated the gorges and canyons which are known to exist, but which are often in one way or another partially hidden. Examples of these are the wide and deep basins which contain most of the Great Lakes, the trough of St. Lawrence River, the extensive submarine trench which extends many miles out from the mouth of the Hudson, the broad and deep valley in which reposes Chesapeake Bay, the deep excavation, refilled apparently to as much as 1,200 feet,[7] in which the lower Mississippi flows. Apparently before the end of the first glacial stage our eastern coast had settled down to about its present level; and there is little evidence and little probability that since that early time the elevation has been much greater than at present. During the greater part of the Pleistocene, therefore, our coastal plain, from New Jersey to the Rio Grande, has been practically stable. In whatever way the terraces were produced, they came into existence during the time of that elevation; and

[7] Louisiana Geol. Survey Bull., 1; 43. 1905.

at the time of the first interglacial stage the low Atlantic shore was ready to receive deposits containing the remains of the animals we now find there.

Consistent with his belief in the theory of the marine origin of the terraces, Dr. Cooke, of course, accepts the interpretation that the deposits and their fossil contents are relatively young. In their joint report Dr. Gidley and Professor Loomis take a similar view of the rather late age of the deposits and of the fossils. The present writer is unable, however, to determine what is the fundamental idea on which their conclusions are based—whether on the theory of marine terraces, the modern aspect of the fauna, or the presence of human remains. The language employed by them appears often rather indefinite, so that each reader can interpret it to suit himself. On page 263 of the joint report a number of geological changes are indicated, but whether these involved any considerable amount of movement or of time is left uncertain. Very few vertebrate fossils are recorded. Two or three species of elephants, varying in structure, habits, geological age, and regional distribution, are included under the vague name mammoth. In short, there is a contrast between the laxity of the argumentation and the assertiveness of the conclusion.

The authors, as shown in their report, are not clear as to the exact age of the bed no. 2 and its fossils, but state that it was "probably pre-Wisconsin." Nor are they certain that the human skull was not originally imbedded in no. 2. If it was, man may have been there in pre-Wisconsin times. Or, as they suggest, the skull may have been crushed and pressed into bed no. 2 by some heavy animal in the interval between bed no. 2 and bed no. 3—therefore, in "possibly early post-Pleistocene," which is, of course, the Recent. The effort is made to bring up the age of the deposit as near the present time as possible, but nowhere is there a reason offered why bed no. 2 may not be as old as the first interglacial, the Aftonian.

In the endeavor to advance bed no. 2 to a late time in the Pleistocene the writers must account for the large extinct fauna found in it. They think it possible "that at this time there was still living in Florida at least a remnant of the Pleistocene fauna, including the mammoth and the mastodon." The suggestion that some of the Pleistocene animals lived longer than others appears to be an attractive one, inasmuch as it is accepted by Dr. Cooke and by Gidley and Loomis. Now, this remnant must have been a pretty substantial one. The writer has estimated that 70 per cent of the species of bed no. 2 is extinct and 30 per cent is yet living, but the 70 per cent includes

many species which became extinct after bed no. 2 was laid down. It is, therefore, not unlikely that the remnant living at the close of deposition of bed no. 2 amounted to half of the fossil species known from Florida. It is hard to understand what advantages the authors of the report gain by exploitation of this remnant. It is the other remnant, the one which appears no more after the deposition of bed no. 2, that is to be considered. We must determine when the saber-tooth tigers (*Smilodon*), the capabaras of bear-like size, *Elephas imperator*, the camels, the horses of two or three species, the giant armadillo (*Chlamytherium*), *Megatherium*, the glyptodonts, the gigantic tortoises, and various species of smaller chelonians ceased to exist. We must not conclude that camels lived on to a late stage of the Pleistocene simply because some of the bisons did; nor that *Elephas imperator* continued on to the early Recent because another "mammoth" may have done so.

In addition to the genera and species mentioned above there have been discovered at Peace Creek, Vero, Melbourne, and various other localities in Florida, mylodons, megalonyx, tapirs, peccaries, long-horned bisons, mastodons, the giant beaver (*Castoroides*), huge dogs, and tigers, besides the great bulk of the species, big and little, which inhabited Florida when Ponce de Leon arrived in search of the fountain of youth. Doubtless all of these had existed somewhere during, we will say, the first interglacial stage. From that time this host had marched abreast some hundreds of thousands of years, down, as we are told, to the "pre-Wisconsin" or even to the "post-Pleistocene." Few or none had fallen exhausted by the wayside; few or none had been destroyed by any hovering enemy; apparently there had occurred no internecine conflicts; and none of the beasts had suffered from the rigors of four glacial stages. Then, as if to announce the tardy arrival of man on the continent and to prepare his environment, nearly three-fourths of that multitude was destroyed suddenly and in as mysterious a way as was the army of Sennacharib.

I am told by Dr. Cooke that some vertebrate paleontologists think that there are more specific differences than I admit between the Pleistocene animals of Florida and those of the glaciated regions. This may be true, but in the present discussion, not very important. A certain elephant, regarded by myself as *Elephas imperator*, may be something else, but it lived with the other genera and species of bed no. 2 and disappeared with them. It is open to anybody to describe from the bones and teeth found in Florida as many new species as he may desire. These new species will be found mostly in bed no. 2 and,

as I view the case, will add to the high percentage of extinct species found in it and confirm its antiquity. As Cooke, Gidley and Loomis interpret the case, all the new species will simply magnify the slaughter that occurred just preceding the alleged late advent of man.

Various persons attach importance to the idea that the Pleistocene animals survived longer in Florida than in the northern States because of its genial climate. These persons must assume that the environment of Florida is even now more favorable for mammalian animals than more northern countries. Apparently the climate preferred by musk-oxen and polar bears is that of the arctic regions; by existing sloths and anteaters, that of the hot tropics; by a great variety of other animals, that of the intervening spaces. These persons must assume further that, even if the climate remained genial during the glacial stages, the animals living there all continued to exist from the early Pleistocene to its close. Mammalian genera and species, quite unlike mollusks, are relatively short-lived. Climate is not the only condition that effects the existence of vertebrates. If for any reason vertebrates from other parts of the continent had invaded Florida in great numbers their intrusion would have led to competition for place and food, and some of the less hardy forms would have succumbed.

The climate of the southern States, however, was probably during each glacial stage less genial than during the interglacial stages. During one stage, probably the Kansan, walruses flourished on the present site of Charleston, South Carolina. In the collection of Mr. C. C. Pinckney, of Charleston, the writer found a milk-tooth of a species of moose closely related to the one now living. Leidy recognized the presence of a musk-ox at Natchez, Mississippi. In his report Dr. Cooke included among the animals exhumed from the bed no. 2, at Melbourne, a possible reindeer. Although the teeth were later identified as those of a young elk, the earlier identification did not appear incongruous either to the geologist or the paleontologist. The climate which was favorable for walruses, moose, musk-oxen and the elk, would not have appeared genial to all of the ground-sloths, the armadillos, glyptodonts, the saber-tooth tigers, the camels, and the huge tortoises, all of which had been accustomed to a semitropical environment.

If those who insist that during glacial stages the climate of Florida was little different from that of the present really understand Pleistocene meteorology, will they not tell us what happened about the time of the introduction of human beings that so many of the animals were swept away?

Naturally the age of bed no. 3 came up for decision by the investigators at Melbourne, and they appear to have found the problem easy of solution. It is assigned to the Recent; but the present writer finds no adequate reason presented. Dr. Cooke states that the freshness of the vegetable remains and of the mussel shells indicates that no very long time elapsed during this accumulation—a conclusion which will not stand investigation. According to Gidley and Loomis, the deposit is somewhat more recent than the appearance of man, which itself was possibly early post-Pleistocene, that is, Recent. No reason is offered why bed no. 3 may not be as old as the Illinoian glacial stage or the Kansan. Much is made of the erosion of bed no. 2, but it might, without any uplift, have been effected by increased rainfall during one glacial stage. The considerable changes of level postulated are assumptions. Apparently few fossils were found in bed no. 3 at Melbourne, probably because of local conditions. At Vero, fifty-two species of vertebrates were collected, of which nineteen were regarded as extinct. The writer is inclined to believe that any of the species that survived the extinction following the deposition of bed no. 2 may yet be discovered in no. 3. In an effort to prove the late date of the bed no. 2, Prof. R. T. Chamberlin contended[8] some years ago that it passed apparently without interruption into bed no. 3. His arguments may fairly be used to show that this upper bed is older than he suspected. The stratum of muck must have accumulated with extreme slowness. The upper portions may really belong to the Recent epoch; the lower portion to late and middle Pleistocene.

The present writer has little to say about Professor Loomis's personal article mentioned above. It appears to be a repudiation of portions of the joint report. On some matters I believe he is right; on others, in error. To the writer it appears that the evidence presented by the three investigators shows that the human skull and some of the artifacts belonged originally in bed no. 2. If further digging from Melbourne to Vero should, as it has done so far, reveal human relics imbedded in this stratum, one would have to conclude either that it was their original resting place or that the proboscideans were animated by an intense dislike at seeing such objects lying around loose on the surface.

[8] Journ. Geol., **25**: 666-683. 1917.

BOTANY.—*Six new Convolvulaceae from Venezuela.*[1] H. PITTIER, Caracas, Venezuela.

Breweria mollis Pittier, sp. nov.

Scandens, caulibus virgatis, verruculosis, dense pubescentibus; foliis nervosis, modice petiolatis, petiolo tereti, tomentoso, laminis submembranaceis, ovalibus, basi rotundatis apicem versus sensim angustatis, obtusis, mucronatis, supra parce adpresse villosis costa venisque impressis, subtus molliter pubescentibus costa venisque prominentibus; racemis axillaribus, subcymosis; pedunculis primariis, secundariis, pedicellisque bracteolis 2 deciduis suffultis fulvescenti-pubescentibus; floribus 3–7, albis (?); sepalis aequalibus, ovatis, apice subrotundatis, 2 exterioribus utrinque, interiorum partibus expositis fulvescenti-pubescentibus; corolla calyce multo longiora, tubo brevi, ventricoso, basi intus villoso, limbo late infundibuliformi, plicato, costulis exterioribus extus dense fulvo-pilosis demum glaberrimo, in aetate utrinque 5-fisso; staminibus corollae basi insertis, filamentis glabris apice incurvis; antheris oblongis basi emarginatis, apicem versus angustatis, dorsifixis; ovario ovoideo, fulvo-pubescenti, disco annulari glabro cincto; stylis 2, brevissimis, basi vix connatis, glabris; stigmatibus globosis; capsula ovoideo-oblonga, calyce persistente glabrescente suffulta; seminibus ovoideis, plano-compressis, margine pilis fulvescentibus longissimis dense coronatis, demum parce pubescentibus.

Petiolus 1.5–2 cm. longus; laminae 7–10 cm. longae, 4–5 cm. latae. Racemi 6–6.5 cm. longi. Pedunculi primarii 2–3 cm. longi; secundarii 0.6–1 cm.; pedicelli circa 1.2 cm. longi. Sepala 6 mm. longa, 4 mm. lata. Corolla 1.3 cm. longa, tubo circa 3 mm. longo. Filamenta circiter 3 mm. longa; antherae 3 mm. longae. Ovarium plus minusve 3.5 mm. longum; stylus 2–2.5 mm. longus; stigmata 0.6 mm. diametientia. Capsula 1.6 mm. longa; semina 6 mm. longa, 5 mm. lata, pilis 1–1.2 cm. longis marginata.

PORTUGUESA: Calvario de Guanare, 200 m., on arid, bushy slopes; flowers and fruits December 28, 1925 (*Pittier* 12046, TYPE).

Breweria longepaniculata Pittier, sp. nov.

Volubilis, ramis sarmentosis subfistulosis; foliis petiolatis, coriaceis; petiolis brevibus, canaliculatis, minute adpresse pubescentibus; laminis ovalibus oblongisve, basi rotundatis, apice obtusis retusisve mucronulatis, supra glaberrimis minute reticulatis subnitidis, subtus sordide cinereo-tomentellis, nervo supra impresso subtus prominente, venis adscendentibus supra tenuiter impressis subtus utrinque prominulis; paniculis axillaribus, apice aphyllo excepto foliosis; cymis pedunculatis bis trifidis ferrugineo-pubescentibus; pedunculo petiolum subaequante vel breviori; pedicellis calyx longioribus; bracteis apiculatis brevibus; sepalis ovatis, obtusis, coriaceis, duobus exterioribus extus dense ferrugineo-pubescentibus, demum plus minusve parce pubescentibus glabrescentibusve; corolla tubuloso-campanulata, basi coarctata, extus dense fulvo-villosa; staminibus basi villoso-lanatis, antheris ovatis, cordatis; disco crasso, cupulato; ovario apice villoso; stylis duobus basi breviter connatis demum liberis filiformibus; stigmatibus capitatis subbilobulatis.

Petiolus 0.5–2.5 cm. longus; laminae 3–10 cm. longae, 2–6 cm. latae. Paniculae circa 25 cm. longae; cymarum pedunculi 0.5–1.2 cm. longi; pedi-

[1] Received February 23, 1927.

celli 5–8 mm. longi. Sepala 6–7 mm. longa, 4–4.5 mm. lata. Corolla circa 1.8 cm. longa. Genitalia inclusa.

TRUJILLO: Moron Hill near Valera 600, m., in bushes; fl. Nov. 18, 1922. (*Pittier* 10733, TYPE).

No South American species of *Breweria* seem to have been described in recent years, and it had not been expected that the genus reached so far north. I feel no hesitation, however, in placing the above described plants in this apparently not well known group, of which they represent two distinct types, the one with axillary, cymose, the other with terminal, paniculate, inflorescences. The affinities of the first species are with *Breweria Langsdorffii*, except that the flowers are not solitary and the general aspect of the plant resembles more that of *Prevostea ferruginea*. The remarkable seeds, with their dense fulvous crown of very long hairs, and the details of the flowers leave no doubt as to the generic identity of that plant; while certain structural analogies show that *B. longepaniculata* is really congeneric with *B. mollis*. A manuscript note on the sheet of the former plant states that "this plant seems to be the same as H. H. Smith's n. 876 from Santa Marta (Colombia) but it is distinct from Juan de la Cruz nn. 1372 or 1358 in the U. S. National Herbarium."

Aniseia trichantha Pittier, sp. nov.

Volubilis, caule subcrasso primum densissime cano-villoso, in aetate plus minusve adpresse villosulo, foliis ovatis oblongisve, basi acutis subacutisve apice late obtusis interdum subacutis utrinque mucronatis supra glabris glabrescentibusve, subtus primum creberrime sericeo-pubescentibus demum parce pilosulis; petiolo modice crasso, canaliculato, villoso; stipulis linearibus, brevibus, cito deciduis; pedunculis axillaribus, validis, tomentoso-villosis, 2–3-floribus, folia subaequantibus longioribusve; pedicellis brevibus dense villosis basi bracteis linearibus pubescentibus deciduis suffultis, apice bibracteolatis, bracteolis ovato-lanceolatis deciduis; sepalis subcoriaceis ovatis ovato-oblongisve, ciliatis, extus in partibus expositis cano-villosis, in sicco nigrescentibus, interioribus brevioribus; corolla alba infundibuliformi, in sicco nigrescenti, extus dense fulvo-pilosa; staminibus glabris; disco annulari, glabro; ovario apice dense fulvo-piloso, stylo gracili glabro, stigmatibus 2, ovalibus, muricatis. Capsula (juv.) ovoidea, dense fulvo-villosa.

Petioli 0.7–1 cm. longi; laminae adultae 2.5–5 cm. longae, 1–2.5 cm. latae; mucro usque ad 2 mm. longus. Pedunculus 3.5–6 cm. longus; pedicelli 2–7 mm. longi. Sepala 6–8 mm. longa, 5–7 mm. lata. Corolla plus minusve 2 cm. longa. Filamenta circa 4 mm. longa. Pistillum 1.5 cm. longum.

COJEDES: Between El Tinaco and San Carlos, in low, damp places along river, flowers and young fruits December 25, 1925 (*Pittier* 12004, TYPE).

On account of its relatively large flowers, *Aniseia trichantha* would hold an intermediary position between Meissner's *Grandiflorae* and *Parviflorae*.[2] It is distinguished from all other representatives of the genus reported from Venezuela by its villous corolla. The following is a key to the species which have been collected in the Venezuela.

[2] Flora brasiliensis, 7: 318. 1869.

Corolla white, glabrous, over 2 cm. long; leaves oblong-lanceate
1. A. martinicensis Choisy

Corolla 2 cm. long or less.

Corolla white, densely pilose without, 2. cm. long; leaves ovate or oblong, the base more or less acute. **2. A. trichantha** Pittier

Corolla blue, glabrous, 1.2–1.7 cm. long; leaves more or less cordate or at least broadly rounded at the base.

Sepals glabrous, inflorescences many-flowered. **3. A. velloziana** Choisy

Sepals tomentose; inflorescences 1–3-flowered. **4. A. heterantha** Choisy

Merremia asterotricha Pittier, sp. nov.

Scandens volubilisve, caulibus, petiolis pedunculisque dense stellato-tomentosis canescentibusque; foliis distincte trifoliolatis; petiolo laminis breviore, anguste canaliculato; foliolis petiolulatis, membranaceis, petiolulis brevibus, canaliculatis, laminis ovali-oblongis, lateralibus basi inaequalibus semi-rotundatis, apice obtusis subacutisve mucronatis, supra stellato-pubescentibus, costa venisque impressis, subtus dense stellato-tomentellis cinerascentibus costa venisque prominentibus; stipulis ovatis, obtusis, deciduis; inflorescentiis axillaribus, cymosis, saepe foliosis; pedunculis primariis folia aequantibus longioribusve, plerumque ebracteatis, pedunculis secundariis tertiariisque bracteis foliaceis, petiolulatis lanceolatis suffultis; pedicellis elongatis, gracillimis; bracteolis lineari-lanceolatis; sepalis membranaceis, oblongo-ovatis, apice obtusis, mucronulatis, exterioribus 2 tomentello-cinerescentibus, interioribus gradatim angustioribus glaberrimis subpellucidis; corolla (alba?) calyce duplo longiora; genitalibus inclusis; filamentis basi pilosiusculis; pollinis granulis laevibus, trisulcatis; ovario ovoideo, dense canescenti-villoso; stylo tenuissimo staminibus duplo superante; capsula desiderata.

Petioli 4.5–5 cm. longi; petioluli 2–8 mm. longi; foliolorum laminae 6–13.5 cm. longae, 2.5–5 cm. latae. Stipulae 3–5 mm. longae. Pedunculi primarii 8.5–11 cm., secundarii 3–5.5 cm., tertiarii 1.2–2 cm. longi; pedicelli 0.6–1.7 cm. longi. Bracteae 1.5–2 cm., bracteolae 0.8–1.2 cm. longae. Sepala circa 10 mm. longa, 2.5–3.5 mm. lata. Corolla 2. cm. longa.

LARA: Along the Turbio River near Barquisimeto; flowers June 1, 1925 (*J. Saer d' Héguert* 248, TYPE).

Merremia nervosa Pittier, sp. nov.

Volubilis, caulibus subtenuibus, striatis, cinereo-tomentellis; foliis parvis, petiolatis, trifoliolatis, petiolis sulcatis, pedunculis pedicellisque cinereo-tomentosis; petiolulis brevissimis, laminis (terminalibus majoribus) ovalibus basi in petiolulum attenuatis apice obtusis subacutisve mucronulatis, supra minute velutinis, nervo venisque impressis, subtus cinereo-velutinis, nervo venisque valde prominentibus; pedunculis axillaribus, paucifloris, bracteis linearibus brevibus deciduis suffultis; pedicellis subumbellatis, quam pedunculus multo brevioribus; bracteolis lineari-lanceolatis persistentibus; sepalis membranaceis, ovato-oblongis, apice indistincte emarginulatis vel interdum mucronulatis, 2 exterioribus stellato-furfurascentibus, interioribus glabris vel partim pubescentibus; corolla alba, glaberrima; genitalibus inclusis; filamentis basi parce villosulis; antheris oblongis, basi cordatis; pollinis granulis laevibus; ovario dense cano-villoso; stylo filiformi, glabro, staminibus subaequilongi.

Petioli 0.5–1 cm. longi; petioluli subnulli; lamina terminalis 3–4 cm. longa, 1.6–2 cm. lata, laterales 2 cm. longae, 1.3–1.6 cm. latae. Pedunculi 3–4 cm.,

pedicelli circa 1 cm. longi. Bracteolae 0.7–1 cm. longae. Sepala 9–13 mm. longa, 6–7 mm. lata. Corolla 2.5 cm. longa.

LARA: Cerro Gordo near Barquisimeto, in arid places; flowers October 1926 (*J. Saer d' Héguert* 294, TYPE).

On account of their trifoliolate leaves and stellate indument, these two species constitute a natural group among the Venezuelan *Merremiae*.

KEY TO THE SPECIES OF MERREMIA KNOWN FROM VENEZUELA

Herbs, erect or hardly voluble
  Leaves wanting and replaced with oblong or subulate scales; corolla white
    1. M. aturensis Hallier
  Leaves present, short petiolate, lineal-ovate; subcordate at the base; corolla yellowish
    2. M. maypurensis Hallier
Scandent or voluble vines
  Leaves simple, distinctly and broadly cordiform; corolla yellow, 2.5 cm. long
    3. M. umbellata Hallier
  Leaves 3-foliolate; indument stellate; corolla white
    Leaflets oval-oblong, distinctly petiololate, the blade 6–13.5 cm. long
      4. M. asterotricha Pittier
    Leaflets oval, almost sessile, the blades 3–4 cm. long
      5. M. nervosa Pittier
  Leaves digitate, with 5 segments; corolla white
    Sepals 6–13 mm. long; plant glabrous; leaflets lanceolate, often toothed
      6. M. quinquefolia Hallier
    Sepals 17–25 mm. long; corolla about 4 cm. long; leaflets entire
      Leaves appressed-pilose; sepals hirsute at the base, the exterior ones acute and longest; corolla 3 cm. long
        7. M. aegyptia Urban
      Leaves glabrous; sepals glabrous, obtuse, the exterior ones shortest; corolla 4 cm. long
        8. M. glabra Hallier

Ipomoea pseudo-Linum Pittier sp. nov.

(Sect. *Orthipomoea*, subsect. *Lobatae*.)—Glabra, erecta, caulibus solitariis virgatis simplicibus, foliosis, foliis sessilibus usque ad basin palmatim pluripartitis, segmentis filiformibus, subteretibus, exterioribus plerumque 2–4-fidis; floribus longe spicatis, axillaribus, pedunculatis; pedunculis solitariis, quam folia brevioribus, basi bracteis 2 minimis lanceolatis suffultis; sepalis membranaceis, lanceolatis ovato-lanceolatisve, apiculatis, exterioribus extus squamoso-papillosis, brevioribus angustioribusque; corolla infundibuliformi, rosea, glabra; staminibus glaberrimis, antheris ovato-lanceolatis basi emarginatis; pollinis granulis muricato-spinulosis; disco annulari, angusto; pistillo glabro, ovario biloculari, loculis biovulatis; stylo incluso, stigmate capitato, bilobulato, papilloso; capsula parva, glabra, laevia; seminibus 4, laevibus.

Caulis 40–50 cm. altus, teres. Foliorum segmenta plus minusve fasciculata 1.5–2 cm. longa. Internodia 1–1.5 cm. longa. Pedunculi 7 mm. longi. Calyx 6 mm. longus, lobis exterioribus brevioribus. Corolla 2.5 cm. longa.

Savannas on the slopes above Caracas, 950–1300 m., in small colonies; fl. July 27, 1927 (*Pittier* 7279, TYPE); same locality, fl. June 17, 1917 (*Pittier* 7218).

This pretty species, which looks like certain *Linum* species, seems to be rather scarce. It is evidently very closely related to *Ipomoea ericoides*

Meissn. described from the state of Goyaz in southern Brazil, but differs in the absence of indument, the comparatively long pedunculate flowers with short calyx and pink corolla and the distinct division of the leaves. Another species somewhat like it and probably closely related is *Ipomoea capillacea* Don, of Mexico, but in our plant the peduncles are shorter, the calyx longer, and the corolla not short, tubulous and red, but four times longer than the calyx, funnel-shaped and pink.

BOTANY.—*New South American species of Liabum.*[1] S. F. BLAKE, Bureau of Plant Industry.

The strictly American genus *Liabum* is, taken in its broad sense, the largest American genus of the Senecioneae aside from *Senecio* itself. About 23 species occur in Mexico and Central America, 1 in the West Indies, and the remainder, some 89 species (including those here described), in the Andes from Venezuela to Peru, Bolivia, and Argentina. The number in the different countries is approximately as follows: Venezuela, 2; Colombia, 19; Ecuador, 32; Peru, 38; Bolivia, 13; Argentina, 4. The new species here described have been distinguished in the course of identification of the large amount of material of the genus accumulated at the United States National Herbarium in recent years, principally from the collections of Dr. F. W. Pennell and Mr. E. P. Killip in Colombia, Prof. A. S. Hitchcock and Dr. J. N. Rose in Ecuador, Mr. J. Francis Macbride in Peru, and Dr. Otto Buchtien in Bolivia. The preparation of a working key to the South American species has been greatly aided by the acquisition of photographs, fragments, and notes of typical specimens at the herbaria at Geneva, Paris, and Kew by the writer in 1925, through the courtesy of the curators of the herbaria mentioned, and through the loan by Dr. J. K. Small of several type specimens from the herbarium of the New York Botanical Garden.

Liabum arthrothrix Blake, sp. nov.

Section *Chrysactinium*; scapose, 1-headed; leaves rosulate, lanceolate or oblanceolate, small, coriaceous, callous-toothed, above bright green and densely pilose with many-celled yellowish hairs, beneath densely white-tomentose; involucre 8–11 mm. high.

Rhizome up to 4 cm. long, horizontal; leaves crowded in a basal rosette, without evident internodes, 1–5.5 cm. long (including the petioliform margined base, this 2.5 cm. long to nearly wanting), 3–8 mm. wide, acute, long-cuneate at base, callous-pointed and with 1–3 callous-pointed teeth on each side above middle, apparently not tomentose above even when young, obscurely triplinerved, the lateral veins concealed beneath by the tomentum, the costa usually evident; scape solitary, slender, 14–28 cm. high, naked, arachnoid-tomentose, pilose throughout with many-celled purplish hairs; head 1.8–3

[1] Received March 21, 1927.

cm. wide; involucre hemispheric, about 5-seriate, strongly graduate, appressed, the outermost phyllaries lance-triangular to ovate-triangular, obtuse to subacuminate, subcoriaceous, scarcely margined, 3-nerved, obscurely ciliolate, 0.6–1.6 mm. wide, the middle ones lance-linear, acuminate to obtuse and apiculate, 3-nerved, thinner, narrowly scarious-margined, obscurely pilose-ciliate, the innermost linear, acuminate, 1–3-nerved, thin, 0.6–1 mm. wide, all often purplish-tinged above, essentially glabrous dorsally; rays about 30, yellow, the tube 3–4.5 mm. long, pilose with many-celled hairs, the lamina linear-elliptic, 4-nerved, 3-toothed, 10–14.5 mm. long, 1.5–2.5 mm. wide; disk corollas yellow, very sparsely short-pilose toward apex of tube, clavate-glandular on teeth, 6.8 mm. long (tube 2.8 mm., throat slender-funnelform, 2.4 mm., teeth 1.6 mm. long); young achenes pilose; pappus simple, pure white, about 4.5 mm. long, the bristles finely hispidulous, not dilated apically.

ECUADOR: Páramo of Lavaguro, Prov. Loxa, Sept. 1864, *Jameson* (U. S.); Yausai, alt. 3700 m., April 1904, *Rivet* 602 (Par.), 604 (Par.); páramo, between Oña and Cuenca, Prov. Azuay, alt. 2700–3300 m., 9–10 Sept. 1923, *Hitchcock* 21645 (type no. 1,195,670, U. S. Nat. Herb.).

Distinguished from *L. acaule* (H. B. K.) Less. and *L. rosulatum* Hieron. by the articulate hairs of the upper leaf surface, and from *L. tenuior*, described below, by its smaller coriaceous leaves which show no sign of tomentum above even when young.

Liabum tenuior Blake, sp. nov.

Section *Chrysactinium*; scapose, 1-headed; leaves rosulate, lanceolate or oblanceolate, medium-sized, papery, callous-denticulate, above dull green, at first thinly arachnoid, rather densely pilose with persistent many-celled hairs, evidently 3–5-plinerved, beneath canescently and persistently arachnoid-tomentose; involucre 14 mm. high.

Rhizome short; leaves about 10 in a basal rosette, 5–7.5 cm. long (including the margined petioliform base, this 1–2 cm. long), 1–1.5 cm. wide, acute, callous-pointed, long-acuminate at base, with 2–5 remote pairs of dark callous teeth (about 0.5 mm. long), comparatively thin, reticulate-veined, the veins conspicuous in transmitted light; scape slender, naked, 43 cm. high, arachnoid-tomentose, glabrescent below, above the middle pilose with delicate, purplish, many-celled hairs, the base of involucre pilose with many-celled yellowish hairs; head about 3 cm. wide; involucre hemispheric, about 5-seriate, strongly graduate, appressed, the outermost phyllaries triangular, obtuse to acute, 3-nerved, with greenish center and narrow subscarious margins, slightly ciliate, 1.5–2 mm. wide, the middle ones narrowly oblong-lanceolate, 1.8–2 mm. wide, acute to acuminate, 3–5-nerved, the innermost linear, acuminate, 1–3-nerved, 1 mm. wide; rays apparently about 30, yellow, short-pilose with many-celled hairs toward apex of tube, the tube 5 mm. long, the lamina elliptic-linear, 4-nerved, obtusish, scarcely denticulate, 16 mm. long, 1.5 mm. wide; disk corollas yellow, pilose on tube especially toward apex, essentially glabrous on teeth, 8 mm. long (tube very slender, 4 mm. long, throat slender-cylindric, 2 mm., teeth linear, acutish, 2 mm.); young achenes pilose, 1.6 mm. long; pappus simple, pure white, 6 mm. long, the bristles slender, hispidulous, not dilated apically.

ECUADOR: Casitagua, May 1903, *Rivet* 478 (type, herb. Par.; photo. and fragm., U. S.).

Closely allied to *L. arthrothrix*, but with longer involucre and much thinner leaves in which the reticulation is evident by transmitted light, while those of *L. arthrothrix* are thick and opaque. The disk corollas of the two species also differ in shape and pubescence.

Liabum bicolor Blake, sp. nov.

Section *Chrysactinium;* herbaceous (?), densely whitish-tomentose except on involucre and upper leaf surface; stems decumbent, branching, leafy below, terminated by long monocephalous peduncles; leaves oblanceolate, subentire, coriaceous, soon green and glabrate above; involucre 11 mm. high.

Leafy portion of stem about 10 cm. long or more, sometimes dichotomously branched, slender, striate; internodes 0.7–4 cm. long; leaves opposite, oblanceolate or narrowly obovate, 2–4.5 cm. long (including the petioliform margined base, this 1.5 cm. long or less), 5–9 mm. wide, obtusish, callous-apiculate, entire or with few remote callous teeth, above at first arachnoid-tomentose, quickly glabrate and dark green, not shining, beneath very densely and thickly whitish-arachnoid-tomentose, obscurely triplinerved; peduncles solitary, naked, erect, about 20 cm. high, slender, arachnoid-tomentose, pilose with delicate, many-celled, purplish hairs; head about 2.8 cm. wide; involucre hemispheric, about 5-seriate, strongly graduate, appressed, the outermost phyllaries triangular, acute, firm, 1–1.5 mm. wide, the middle ones lance-linear, 3-nerved, the innermost linear, 1–3-nerved, acuminate, 0.7–1 mm. wide, narrowly subscarious-margined, all obscurely ciliolate, with purplish tips; rays about 30 or more, yellow, the tube pilose above with several-celled hairs, 3 mm. long, the lamina elliptic-linear, 4-nerved, entire, obtuse, 12 mm. long, 1.3 mm. wide; disk corollas yellow, pilose with several-celled hairs on tube and base of throat, sparsely clavate-glandular toward tip of teeth, 7.3 mm. long (tube slender, 4 mm., throat slender-campanulate, 1.3 mm., teeth nearly linear, acutish, 2 mm.); young achenes pilose; pappus simple, pure white, 5 mm. long, the bristles hispidulous, not dilated apically.

ECUADOR: Mountains, Prov. Loxa, Sept. 1864, *Jameson* (type no. 534900, U. S. Nat. Herb.)

Evidently closely allied to the Peruvian *L. caulescens* Hieron. The latter is described as having oblong-cuneate subcoriaceous leaves and 1-nerved middle phyllaries.

Liabum amphothrix Blake, sp. nov.

Section *Chrysactinium*; caespitose, whitish-tomentose throughout except on involucre; stems decumbent, somewhat branched, terminating in elongate monocephalous peduncles, leafy below; leaves lanceolate to nearly linear, above pilose with several-celled hairs and persistently or fugaciously arachnoid-tomentose, beneath whitish-arachnoid-tomentose; involucre 9–12 mm. high.

Herbaceous or suffruticulose; stems several, often dichotomously branched, the leafy portion 2–20 cm. long, slender; internodes mostly 0.5–2.5 cm. long; leaves opposite, 2.5–5.5 cm. long (including the petioliform base), 3–10 mm. wide, repandly few-denticulate or sometimes subentire, acute or acuminate, callous-apiculate, papery to subcoriaceous, triplinerved, the margin sometimes revolute, the upper surface densely pilose with several-celled persistent yellowish hairs (on the upper leaves sometimes represented only by subsessile

glands or even these nearly wanting), and at first arachnoid-tomentose, the tomentum often nearly or quite deciduous; peduncles solitary at tips of stems and branches, slender, naked, 13–30 cm. high, arachnoid-tomentose and especially above pilose with delicate many-celled purplish hairs; heads 3–3.5 cm. wide, decurved after flowering; involucre hemispheric, about 5-seriate, strongly graduate, appressed, the outermost phyllaries ovate or oblong-ovate, 1.5–2.8 mm. wide, obtuse, callous-apiculate, 3-nerved, very thinly arachnoid-ciliate, sometimes arachnoid-tomentose when young, the middle ones lance-oblong, acute or acuminate, callous-pointed, 3-nerved, the innermost linear or lance-linear, acuminate, 1–3-nerved, more broadly subscarious-margined, all obscurely glandular-puberulous on back above or essentially glabrous, often purplish above; rays about 30, yellow, the tube pilose with many-celled hairs, 3–4 mm. long, the lamina elliptic-linear, 4-nerved, 2–3-denticulate, 9–16 mm. long, 1.7–2.5 mm. wide; disk corollas yellow, pilose on tube above with many-celled hairs, clavate-glandular on teeth and sometimes on throat, 6.5–7 mm. long (tube slender, about 3.3 mm., throat campanulate, 1.5 mm., teeth nearly linear, acutish, with papillose apical crest, 1.8–2.3 mm.); receptacle paleaceous-fimbrillate, the fimbrillae about 1.2 mm. long; young achenes silky-pilose; mature achenes obovoid, somewhat compressed, 2.3 mm. long, 1 mm. wide, 8–9-ribbed, pilose especially above with white, brown-based hairs, densely verrucose especially on ribs below; pappus nearly simple, about 2-seriate, pure white, somewhat unequal, 5 mm. long, the bristles hispidulous, not thickened above.

PERU: In deep grass of slopes, Mito, Dept. Huánuco, alt. 2745 m., 8–22 July 1922, *Macbride & Featherstone* 1665 (type no. 518161, herb. Field Mus.; dupl. in U. S. Nat. Herb.); sunny grassy swale, Chinchapalca, about 13 km. above Mito, alt. 2900 m., 16–27 July 1922, *Macbride & Featherstone* 1591 (Field, U. S.); among rocks, about 24 km. northeast of Huánuco, alt. 3965 m., 12–22 June 1922, *Macbride & Featherstone* 2157 (Field, U. S.).

Allied to *L. caulescens* Hieron. and *L. bicolor* Blake, but distinguished by the persistent jointed pubescence of the upper leaf surface, which is sometimes lacking on the uppermost leaves. No. 1591 is a form with leaves only about 3 mm. wide.

Liabum perfoliatum Blake, sp. nov.

Section *Starkea* (?); stem, peduncles, and lower leaf surface tomentose; leaves elliptic or ovate-elliptic, crenate, green and bullate above, connate-perfoliate; heads small, in umbels of about 3 at apex of elongate peduncles, slender-pedicelled; involucre 6–7 mm. high, strongly graduate, the phyllaries oval to linear-elliptic, obtuse, appressed.

Perennial herb, 60 cm. high; stem essentially simple, subterete, sometimes weakly grooved, densely grayish-tomentose, bearing about 10 pairs of leaves and 1–3 terminal peduncles; leaves 4.5–11 cm. long, 1.8–4 cm. wide, acuminate to a usually obtuse apex, cuneately and gradually or sometimes abruptly narrowed to the connate bases (these 2–7 mm. wide), crenate-dentate (teeth low, rounded, crenulate, 5–7 mm. apart), thin-papery, above deep green, quickly glabrous, strongly and beautifully bullate, beneath densely whitish- or grayish-tomentose, featherveined, the lateral veins about 8–10 pairs, not prominent; peduncles slender, 10–16 cm. long, rather thinly tomentose and finely pilose chiefly above with jointed purplish hairs; bracts minute, 2 mm. long; pedicels erect, 1–5.5 cm. long, naked, normally monocephalous; heads 2 cm. wide; disk 7 mm. high; involucre campanulate, 5–6-seriate, thinly arach-

noid, glabrescent or glabrate, the outermost phyllaries ovate or oval, about 1 mm. long, rounded, the next ovate to oval, rounded, with greenish 3-nerved center and narrow substramineous margin, about 1.5 mm. wide, the inner linear-elliptic or linear, obtusish or acutish, substramineous with greenish midnerve; receptacle alveolate, the alveolar margins subentire, about 0.2 mm. high; rays about 15, yellow, the tube and base of back pilose, the lamina oblong, about 10 mm. long, 2 mm. wide; disk corollas (immature) comparatively few, yellow, sparsely pilose on tube, hispidulous at apex of teeth; young achenes about 7-ribbed, sparsely pubescent, 0.7 mm. long; pappus yellowish white, of about 12 unequal, flattened, fragile, hispidulous bristles 1.5–2.5 mm. long, and perhaps also a few short squamellae.

COLOMBIA: In forest, "La Gallera," Micay Valley, Dept. El Cauca, Cordillera Occidental, alt. 2000–2200 m., 1 July 1922, *Killip* 7952 (type no. 1,140,317, U. S. Nat. Herb.).

A most distinct species of the *L. grandiflorum* group, readily recognized by its leaves, inflorescence, and involucre. The disk corollas, achenes, and pappus are too immature to be described satisfactorily.

Liabum amplexans Blake, sp. nov.

Section *Starkea*; herb; stem, lower leaf surface, peduncle, and pedicels tomentose; leaves broadly ovate, rough above, triplinerved, abruptly narrowed into short, broadly winged, connate-clasping petioles; peduncle solitary, terminal, elongate, the heads medium-sized, about 10 in a subsimple umbellate cyme; involucre 9–11 mm. high, the phyllaries lance-subulate, acuminate.

Stem apparently decumbent at base, obtusely about 6-angled, 3 mm. thick, below thinly arachnoid-tomentose and densely pilose with jointed purplish hairs, above obscurely jointed-pilose; lower internodes 1.5–5 cm. long, the uppermost one 15 cm.; leaves in few pairs, the larger broadly cordate-ovate, the blades 4.5–7.5 cm. long, 3.5–5.5 cm. wide, abruptly contracted into broadly winged connate-clasping petioles 7–15 mm. long and 4–10 mm. wide, acute, closely serrate with callous-mucronate teeth (the mucros slender, 1 mm. long), firm papery, above dull deep green, subbullate, densely-hispidulous with jointed yellowish hairs, and with a slight fugacious arachnoid tomentum, beneath densely whitish-tomentose, along veins densely pilose with jointed yellowish brown hairs, triplinerved from base of blade and reticulate, the veins and veinlets prominulous beneath; uppermost pair of leaves smaller, 3 cm. long; peduncle 18 cm. long; principal bracts narrow, bladeless, 1 cm. long; pedicels mostly 2.5–4.5 cm. long; involucre hemispheric, about 6-seriate, strongly graduate, the phyllaries triangular-subulate to linear, acuminate or attenuate, 1-nerved, 1–1.4 mm. wide, erect, thinly arachnoid, glabrate or glabrescent, ciliolate, the inner puberulous above, the outer purplish, the inner substramineous; receptacle alveolate, the alveolar margins toothed, about 0.3 mm. high; rays about 32, yellow, pilose on tube and base of back, the tube 3.5 mm. long, the lamina linear, 4-nerved, bidenticulate, 6.5 mm. long, 1 mm. wide; disk corollas numerous, yellow, glabrous except for the apically hispidulous teeth, 6.7 mm. long (tube 3.4 mm., throat campanulate, 1.3 mm., teeth apically thickened, 2 mm.); immature achenes 10-ribbed, pilose, 1.2 mm. long; pappus yellowish white, the inner bristles hispidulous, obscurely or not dilated apically, 5 mm. long, the outer few, setiform, 0.5–1 mm. long.

ECUADOR: Vicinity of Las Juntas, 29 Sept. 1918, *Rose, Pachano, & Rose* 23232 (type no. 1,023,386, U. S. Nat. Herb.).

Allied to *L. grandiflorum* (H. B. K.) Less., in which the leaves are smooth to the touch above and the involucre 13 mm. high, and to *L. weberbaueri* Muschl., which is described as having the leaves arachnoid-tomentose and glabrate above, the involucre shorter and phyllaries broader, and the rays longer. *Hitchcock* 21452, from between Loja and San Lucas, may be a poorly developed form of *L. amplexans*.

Liabum subcirrhosum Blake, sp. nov.

Section *Andromachia;* plant densely whitish-arachnoid-tomentose except on upper leaf surface and involucre; leaves triangular-ovate, greenish above, borne on slender, very narrowly margined, connate-auriculate petioles; heads medium-sized, in small rather close cymes; involucre 11–12 mm. high, the phyllaries all subulate, densely glandular-pilose above, attenuate, the inner subcirrhous-tipped.

Apparently herbaceous, "80 cm. high;" stem terete, 4 mm. thick, hollow, branched above; internodes mostly 4–8 cm. long; leaves opposite, the upper alternate; petioles 2.5–3 cm. long, abruptly dilated at base into connate mucronate-denticulate auricles 4–7 mm. high; blades 6–7.5 cm. long, 3.5–4 cm. wide, acuminate, at base narrowly or broadly cuneate, mucronulate along margin (mucros slender, callous-tipped, 0.5 mm. high, 3–10 mm. apart) and obscurely repand, thin-papery, above thinly arachnoid and puberulent, glabrescent, beneath densely white-arachnoid-tomentose, subtriplinerved (the veins about 6 pairs, the lowest pair somewhat stronger than the others); heads about 2.5 cm. wide, in irregular cymose clusters of 3–8 at apex of stem and branches, the densely tomentose pedicels mostly 2–4 cm. long; involucre about 5-seriate, strongly graduate, arachnoid-tomentose at base, densely glandular-pilose with yellowish white (or in the outer phyllaries purplish) hairs above, the phyllaries all 1 mm. wide or less, subulate to narrowly linear-subulate, with loose attenuate tips (in the innermost subcirrhous), the outer purplish, the inner greenish stramineous, the middle ones 3-nerved; receptacle merely foveolate; rays about 50, yellow, pilose on tube and base of back, the tube 3 mm. long, the lamina linear, 4-nerved, 3-denticulate, 9 mm. long, 1.2 mm. wide; disk corollas numerous, yellow, slenderly cylindric-funnelform, sparsely pilose on tube and throat, pilose-tufted at apex of teeth, 6.4 mm. long (tube 2.2 mm., throat scarcely distinguished, 1.8 mm., teeth 2.4 mm); achenes densely hispidulous, 1.8 mm. long; pappus double, brownish white, the inner of 20 or more fragile, strongly hispidulous, not apically dilated bristles 6 mm. long, the outer of about as many persistent blunt lacerate squamellae about 0.3 mm. long.

ARGENTINA: Rare, La Playa, Dept. Andalgalá, Prov. Catamarca, 12.2. 1917, *P. Jörgensen* 1673 (type no. 922182, U. S. Nat. Herb.).

Allied to *L. candidum* and *L. auriculatum* Griseb., especially the former, from which it is distinguished by its considerably narrower phyllaries with extremely attenuate tips. The three may eventually require a separate section for their reception.

Liabum excelsum (Poepp.) Blake.

Andromachia excelsa Poepp. Nov. Gen. & Sp. **3**: 44. 1845.

This species has not been recognized among the material examined, but from description seems to be distinct. It is customary to cite the new plants

described in all three volumes of the "Nova Genera ac Species" as of Poeppig & Endlicher. The title pages of the first two volumes bear the names of both botanists, but that of volume 3 the name of Poeppig only, so that it seems necessary to attribute to Poeppig alone the authorship of the new genera and species in this volume.

Liabum mikanioides Blake, sp. nov.

Section *Oligactis;* scandent shrub; stem and branches densely short-pilose with jointed brownish hairs and obsoletely arachnoid-tomentose; leaves ovate or oval-ovate, serrulate, coriaceous, glabrous above, densely tomentose beneath, short-petioled; heads small, 10-flowered, subsessile, very numerous and subspicate on the wide-spreading branches of axillary and terminal pyramidal panicles.

Stem subterete, striate, solid, brown-pithed, 3–5 mm. thick; leaves opposite; petioles very stout, 8–10 mm. long, naked, not auriculate, above flattish and persistently sordid-tomentose, beneath rounded and glabrate; blades 6–11 cm. long, 3.5–6.5 cm. wide, acute or obtusish, broadly cuneate-rounded at base, callous-serrulate except toward base (teeth acutish, 0.5 mm. high, 2–8 mm. apart), above deep dull green, quickly glabrate and smooth except usually along costa, beneath densely tomentose with brownish-white hairs, featherveined, the chief lateral veins 8–10 pairs, prominulous above, prominulous and glabrescent beneath; panicles about 15 cm. long, 8 cm. wide, the branches densely floriferous except at base, spreading at a right angle, the lower ones subtended by reduced leaves, the heads spicately clustered on short branchlets; involucre 5–6-seriate, strongly graduate, 3.5 mm. high, the phyllaries ovate (outer) to linear-elliptic, 1 mm. wide or less, obtuse, firm, brownish, somewhat darkened toward apex, essentially nerveless, somewhat deciduously arachnoid-pilose-ciliate and ciliolate; receptacle alveolate; corollas not seen; achenes about 10-ribbed, pilose, 2 mm. long; pappus yellowish white, double, the inner of about 30 hispidulous, apically dilated, somewhat flattened bristles 4.5 mm. long, the outer of about 20 narrowly linear acute or acuminate squamellae 1.2–1.5 mm. long.

COLOMBIA: "Climbing shrub, flowers yellow," in clearing, "Alaska," above Salento, Cordillera Central, Dept. Caldas, alt. 3000–3400 m., 10–13 Aug. 1922, *Pennell* 9706 (type no. 1,141,228, U. S. Nat. Herb.).

Closely allied to *L. sessiliflorum* (H. B. K.) Less. In that species the branches are persistently arachnoid-tomentose, without jointed hairs, and the leaves are elliptic to elliptic-oblong, acuminate, one-quarter to one-half as wide as long. The species is named in reference to its close habital resemblance to such species of *Mikania* as *M. houstoniana* (L.) Robinson.

Liabum subviride Blake, sp. nov.

Section *Munnozia*; stem 6-angled, arachnoid, soon glabrate; leaves triangular-hastate, soon glabrous and green on both sides, the petioles narrowly winged above, connate-auriculate at base; heads small, yellow, very numerous in a terminal flattish panicle.

"Shrub;" stem (above) weak, hollow, about 5 mm. thick, rather obtusely 6-angled, striate, reddish-brown, sparsely arachnoid, soon nearly completely glabrate; leaves opposite; petioles cuneately margined above (or in the uppermost leaves nearly to base), 2–4.5 cm. long, 4–7 mm. wide above, connate-auriculate at base, the appendages reniform, about 3 mm. high; blades 10–11

cm. long, 7.5–9.5 cm. wide across the wide-spreading, narrow, acuminate basal lobes, 3.5–5.5 cm. wide just above them, acuminate or attenuate, at base subtruncate and then shortly cuneate-decurrent on petiole, repand-dentate or serrate (teeth 1–3 mm. high, 3–8 mm. apart), above deep green, thinly arachnoid, glabrate or glabrescent, beneath somewhat lighter green, thinly arachnoid, quickly glabrate except sometimes along costa, subpapyraceous, triplinerved from near base, the veins delicate, barely prominulous beneath; panicle ternately divided, about 18 cm. long and wide, very many-headed, flattish, pilosulous with several-celled brownish hairs, the pedicels very slender, mostly 2–2.5 cm. long, the lowest bracts of inflorescence similar to the leaves but smaller, the others mostly tiny, subulate-linear; heads about 42-flowered, about 1.5 cm. wide; disk in fruit 7–8 mm. high; involucre campanulate-hemispheric, about 4-seriate, strongly graduate, 4–6 mm. high, the phyllaries lance-ovate or oblong-ovate (outer 1.3–1.5 mm. wide) to narrowly oblong, acute, the outer thinly pilose-ciliate, 3–5-nerved, and with short subherbaceous tips, the inner substramineous, essentially glabrous, 3-nerved; rays about 20 (?), 1-seriate, the tube pilose, 2.2 mm. long, the lamina elliptic, 2-3-denticulate, 6.5 mm. long, 1.8 mm. wide, glandular-puberulent dorsally; disk flowers about 24 (?), the corollas 5.5 mm. long (tube slender, pilose with jointed hairs above, 3 mm. long, throat campanulate, 0.8 mm. long, teeth 1.7 mm. long, slightly yellowish-crested at tip, clavate-glandular on back above); receptacle deeply alveolate, the alveolar margins lacerate-ciliate, about equaling the ovaries; achenes subterete, about 10-ribbed, hirsutulous above, 1.2 mm. long; pappus brownish-white, the inner bristles numerous, slender, not thickened apically, hispidulous, 5 mm. long, the outer few, similar, half or two-thirds as long.

PERU: "Shrub with yellow flowers," Lucumayo Valley, not far from Ollantaytambo, Prov. Cuzco, alt. 1800–3600 m., 19 June 1915, *O. F. Cook & G. B. Gilbert* 1365 (type no. 604546, U. S. Nat. Herb.).

Related to *Liabum hastifolium* Poepp. In a long series of that species from Columbia, Ecuador, Peru, and Bolivia, the leaves are always densely pilose with jointed hairs above and persistently white- or gray-tomentose beneath, the petioles are never auricled, and the panicle is nearly always strongly convex.

Liabum angustum Blake, sp. nov.

Section *Munnozia*; branches 6-angled, densely pilose with dark many-celled hairs below, above thinly arachnoid and less densely pilose; leaves narrowly lance-hastate, glabrous above, white-tomentose beneath, the slender naked petioles connate-auriculate; heads rather small, in loose cymose panicles on axillary and terminal branches; involucre 5–6 mm. high, essentially glabrous.

"Liana;" branches pithy, 3–4 mm. thick, 6-angled and striate; leaves opposite; petioles slender, channeled, 2–2.5 cm. long, sparsely pilose and arachnoid, essentially naked except at base where abruptly widened into connate auricles, the appendages reniform or semiorbicular, subentire, up to 8 mm. long; blades narrow-lanceolate or linear-lanceolate, 8–11 cm. long, 0.8–2.4 cm. wide across the short narrow acuminate (sometimes obsolete) basal lobes, about the same breadth near middle, long-acuminate and somewhat falcate, very shortly cuneate at base, remotely callous-denticulate, coriaceous, above deep green, glabrous, beneath densely and closely whitish-tomentose (the costa and chief veins glabrate), weakly triplinerved; heads (immature) about

1.8 cm. wide, in 4–7-headed narrow cymose panicles on axillary and terminal peduncles, these densely puberulent with short dark many-celled hairs and obscurely arachnoid, the bracts small, linear, the pedicels flexuous, divaricate, mostly 2–3 cm. long; involucre about 4-seriate, slightly graduate, the outermost phyllaries few, lance-oblong, acute, ciliate, the next ovate or oval-ovate, 5–7-nerved, about 1.5 mm. wide, substramineous, with short subherbaceous subglandular acute tip, the innermost linear-lanceolate, acuminate, glabrous, about 3-nerved; receptacle deeply alveolate, the alveolar margins lacerate, membranous, about 3 mm. long; rays (very immature) about 35, the tube and base of limb pilose, the tube about 1 mm. long, the lamina 4-nerved, linear, bidenticulate, about 6 mm. long; disk corollas (very immature) about 66, pilose on tube, clavate-glandular toward tip of teeth, 4 mm. long (teeth 1.5 mm); immature achenes hispidulous; pappus (immature) brownish, about 4 mm. long, setose, not obviously biseriate.

PERU: "Liana, flowers light yellow," Villcabamba, an hacienda on Río Chinchao, Prov. Huánuco, alt. 1830 m., 17–26 July 1923, *Macbride* 5198 (type no. 536236, Field Mus.; dupl. no. 1,191,539, U. S. Nat. Herb.).

Allied to *L. lanceolatum* (Ruiz & Pav.) Sch. Bip., to which *Cook & Gilbert* 1361 and 1370, from the Lucumayo Valley of Peru, are somewhat doubtfully referred. In that plant the leaves are hastate-sagittate and strongly cordate at base, there are no "stipular" appendages, and the stem lacks the long dark hairs of *L. angustum*. The Peruvian *L. trinerve* (Ruiz & Pav.) Sch. Bip. and *L. venosissimum* (Ruiz & Pav.) Sch. Bip. are also allied, but both are so briefly described that they cannot be identified without examining authentic specimens.

LIABUM SAGITTATUM Sch. Bip. Flora **36**: 37. 1853.

Munnozia sagittata Wedd. Chlor. And. **1**: 211. 1857.
Chrysastrum sagittatum Willd.; Wedd. Chlor. And. **1**: 211. 1857, as synonym.
Liabum hastatum Britton, Bull. Torrey Club **19**: 263. 1892.
Munnozia hastata Wedd.; Britton, Bull. Torrey Club **19**: 263. 1892, as synonym.

This common species, ranging from Colombia to Peru and better represented in herbaria than most members of the genus, is variable in involucral characters and may be capable of subdivision. Owing to uncertainty as to the identity of *L. trinerve* (Ruiz & Pav.) Sch. Bip. and *L. venosissimum* (Ruiz & Pav.) Sch. Bip., which are evidently very closely related, it seems best at present not to attempt segregation. Schultz's species was based on a Humboldt plant in the herbarium of Willdenow, said to be from Peru, and on *Linden* 805 and *Funck & Schlim* 1293 from Colombia. Weddell's name, independently proposed but likewise derived from Willdenow's herbarium name, was based on *Jameson* 392 from Ecuador and three collections from Colombia (*Humboldt & Bonpland, Goudot*, and *Funck & Schlim* 1293). The sheet of *Jameson* 392 in the Kew Herbarium bears the false name *Munnozia hastata* Wedd., on which Britton based the name *Liabum hastatum*, although citing the page of the "Chloris Andina" on which the name *M. sagittata* appears. Willdenow's generic name, *Chrysastrum*, was published (as a subgenus) by Schultz in the form *Chrysartrum*, evidently by error.

Liabum eriocalyx Blake, sp. nov.

Section *Munnozia*; suffrutescent; stem subterete, densely arachnoid-tomentose, glabrate below; leaf blades narrowly oblong, about 4 times as long as wide, slightly hastate or sagittate, subpenninerved, above densely pubescent with short several-celled hairs and somewhat arachnoid, beneath densely and sordidly arachnoid-tomentose, the stout petioles wingless, exauriculate; heads few, cymose, medium-sized; involucre 7–8 mm. high, scarcely graduate, densely and persistently arachnoid-tomentose.

"Half-woody liana;" stem stout, 5–8 mm. thick, striate-ridged, the tomentum brownish-white; internodes on young branches 1–4 cm. long, on the old stem elongate; leaves opposite; petioles 1.5–3 cm. long, sometimes barely winged above, channeled, densely arachnoid-tomentose and beneath the wool sordid-pubescent with jointed hairs; blades 9–12.5 cm. long, 2–3 cm. wide, acuminate, callous-pointed, at base short-cuneate to subtruncate or slightly cordate (the ears short, about 3 mm. long), callous-denticulate (teeth 0.5 mm. high, 4–8 mm. apart), coriaceous and apparently fleshy; heads 2.5–3 cm. wide, 5–9 in a terminal cyme or cymose panicle (the lower branches subtended by leaves), the pedicels tomentose, mostly 5–10 cm. long; involucre broad, about 4-seriate, the outer phyllaries ovate or oval-oblong, obtuse, about 3 mm. wide, the innermost lance-oblong to linear-lanceolate, acute or acuminate, 3–5-nerved, glabrate; receptacle deeply alveolate, the alveolar margins submembranous, ciliate, about 3 mm. long; rays about 28, yellow, pilose on tube and base on back, the lamina linear, 4 (rarely 6) -nerved, 15 mm. long, 1.5 mm. wide; disk corollas numerous, yellow, pilose on tube, 9.2 mm. long (tube 5 mm. long, throat 2.2 mm., teeth 2 mm., apically thickened); young achenes turbinate, about 10-ribbed, hispidulous, 1.3 mm. long; pappus brownish white, of slender hispidulous graduate setae, not thickened apically, the inner 6 mm. long, the outer about 3 mm. long.

PERU: "Semi-woody liana in partially sunny thicket," Hacienda Schunke, La Merced, Dept. Junin, alt. 1220 m., 27 Aug.–1 Sept. 1923, *Macbride* 5783 (type no. 536813, Field Mus.; dupl. no. 1,191,551, U. S. Nat. Herb.).

Nearest *L. corymbosum* (Ruiz & Pav.) Sch. Bip., which has a thinly arachnoid or glabrate involucre and shorter, proportionately much broader leaves (the blades 5.5–10 cm. long, 3–5 cm. wide).

LIABUM CORYMBOSUM (Ruiz & Pav.) Sch. Bip. Flora 37: 34. 1853. *Munnozia corymbosa* Ruiz & Pavon, Syst. Veg. Peruv. Chil. 195. 1798.

This species, very briefly described by its authors, is represented at the Paris Herbarium by a sheet from the herbarium of Pavon, received from Boissier and labeled *Munnozia corymbosa*, Fl. Peru. Agreeing well with the short diagnosis, it may be accepted as authentic for the species. Fragments of this plant obtained for the National Herbarium through the courtesy of Dr. H. Lecomte agree excellently with Macbride's no. 3886 from Huacachi, near Muña, Peru, alt. 1980 meters, described as a liana with fleshy upper parts and bright yellow flowers. The species is distinguished, among the Munnozias of the *L. sagittatum* group, by its fleshy, densely rufescent-lanate-tomentose young branches and its triangular-ovate, merely cordate or slightly sagittate leaves (5.5–10 cm. long, 3–5 cm. wide). above densely pubescent with jointed hairs and at first arachnoid-tomentose, beneath grayish-tomen-

tose. The heads are about 10 to 13, long-peduncled at tips of branches in loose cymose panicles, and the involucre is 7–8 mm. high; the petioles are not auriculate.

Liabum isodontum Blake, sp. nov.

Section *Munnozia*; stem, petioles and inflorescence thinly arachnoid-tomentose and densely pilose with jointed purplish hairs; leaves oblong-triangular, sagittate-hastate, weakly triplinerved and veiny, rather evenly dentate, pilose above, grayish-tomentose beneath; petioles naked, not auriculate; heads numerous, medium-sized, cymose-panicled, long-pedicelled; outer phyllaries ovate or ovate-lanceolate, 2 mm. wide or more.

Suffrutescent (?); stem stout (5 mm. thick), subterete, striate; leaves opposite; petioles slender, 3.5–5 cm. long, 1–2 mm. wide, channelled above; blades 11–13.5 cm. long, 4–5.5 cm. wide, acuminate, sagittate-hastate with broadly triangular sinus and short, acuminate lobes, rather evenly crenate-dentate (teeth about 2 mm. high, 3–6 mm. apart, acute but usually appearing obtuse by the reflexing of the tips), firm-papery, above deep green, rather densely pilose with weak, jointed, brownish hairs, beneath similarly pilose along the veins and thinly gray-tomentose; heads about 3–3.5 cm. wide, about 40 in a loose panicle made up of axillary and terminal branches, the upper bracts small, linear-subulate, the pedicels usually 2–5 cm. long; involucre about 4-seriate, somewhat graduate, 7–8 mm. high, short-pilose with jointed purplish hairs, the outermost phyllaries ovate, acute or subacuminate, purplish above, usually 2–2.8 mm. wide, the others lance-ovate to (inner) lanceolate, acuminate, 3–7-nerved, the lax tips purplish or in the innermost greenish; receptacle deeply alveolate, the alveolar margins lacerate-ciliate, about 3 mm. long; rays 20 or more, yellow, pilose on tube and back, the tube 3 mm. long, the lamina linear, 4-nerved, bidenticulate, 2.3 cm. long, 1.5 mm. wide; disk corollas numerous, yellow, 8 mm. long (tube 3 mm., pilose with jointed hairs of biseriate cells, throat slender, 2.2 mm., teeth 2.8 mm., clavate-glandular on back and sparsely pilose-barbate near apex); young achenes turbinate, densely hirsute-pilose; pappus brownish white, of slender weakly hispidulous graduate setae, not dilated at apex, the inner 6 mm. long, the outermost 1 mm. long.

BOLIVIA: Unduavi, North Yungas, alt. 3300 m., Nov. 1910, *Buchtien* 4808 (type no. 1,179,268, U. S. Nat. Herb.).

Nearest *L. glandulosum* Kuntze, also a Bolivian species, known only by the type in the herbarium of the New York Botanical Garden. In that plant the leaves (only the uppermost known) are broadly triangular (8 by 5 cm.), coarsely doubly dentate with acute teeth and with long, slender, acuminate, wide-spreading basal lobes; the petioles are broad and submarginate; and the phyllaries are all narrowly lanceolate or oblong-lanceolate and less than 2 mm. wide.

Liabum taeniotrichum Blake, sp. nov.

Section *Munnozia;* stem densely and sordidly spreading-pilose with many-celled dark hairs and sparsely arachnoid; leaves petioled, oblong-ovate, shallowly cordate at base, repand-dentate, above green and evenly pilose on surface with many-celled dark hairs, beneath similarly but more densely pilose and with a very sparse arachnoid tomentum; heads several, rather

large, long-peduncled, with numerous long rays; involucre about 8 mm. high, the phyllaries slightly graduate, ovate to lanceolate, acuminate, loose, ciliolate and pilose; achenes densely pilose.

Stem herbaceous above, striate, 4 mm. thick; leaves opposite; petioles naked, not auriculate at base, pubescent like the stem, 2.5 cm. long; blades 13.5 cm. long, 6 cm. wide, acuminate, callous-tipped, rather coarsely repand-dentate throughout except toward apex (teeth acute, callous-tipped, about 2 mm. high, 4–8 mm. apart), more densely pilose along the veins on both sides, papery, obscurely triplinerved, weakly prominulous-reticulate on both sides, the basal pair of nerves arising near the base, strongly curved, extending about one-third length of leaf, the other chief lateral veins 6–7 pairs, spreading nearly at a right angle, all uniting near margin of blade; uppermost leaves much smaller, oblong-ovate, cuneate at base; heads 4.5 cm. wide, yellow, the peduncles 11–17 cm. long, axillary and terminal, 3–4-headed, the bracts subulate, about 1 cm. long, the pedicels 3–8 cm. long, pubescent like the stem; involucre about 3-seriate, scarcely graduate, the outermost phyllaries ovate or lance-ovate, with pale subchartaceous body and short loose or spreading acuminate herbaceous tip, the inner lanceolate, with loose acuminate subherbaceous tips, all rather sparsely or densely pilose on surface with purplish or whitish, jointed, sometimes gland-tipped hairs, densely ciliolate with whitish hairs, and at first somewhat arachnoid; receptacle deeply alveolate, the alveolar margins lacerate-ciliate, about 3 mm. long; rays about 40, hirsute on tube and back (the hairs composed of 2-seriate cells, not notched at apex), the tube 2 mm. long, the lamina linear, 4-nerved, 3-denticulate, 17 mm. long, 2 mm. wide; disk corollas very numerous, densely spreading-hirsute on tube, base of throat, and teeth, sparsely so on throat (the hairs of 2-seriate cells), 6.5 mm. long (tube 2.3 mm., throat oblong, 1.7 mm., teeth 2.5 mm.); achenes (very immature) turbinate, densely appressed-pilose, 1 mm. long; pappus of numerous yellowish-white hispidulous bristles 6 mm. long and some shorter equally slender outer ones 1.5–2.5 mm. long.

PERU: Province of Chachapoyas, *Mathews* (type in Kew Herb.; photog. and fragm., U. S. Nat. Herb.).

Evidently close to *L. isodontum*, described above, but without the sagittate leaf-bases of that species.

Liabum pulchrum Blake, sp. nov.

Section *Munnozia;* stem, petioles, and inflorescence thinly arachnoid-tomentose and densely pilose with dark jointed hairs; leaf blades triangular-hastate, lobulate-decurrent on upper part of petiole, persistently jointed-pilose above, the petioles with large, dentate, connate auricles; heads large, in a loose cymose panicle, long-pedicelled; involucre 1.2–1.5 cm. high.

"Liana;" stem stout, weak, hollow, bluntly striate-angled, 5–8 mm. thick, the tomentum deciduous below; leaves opposite; petioles 5–7 cm. long, rather slender, lobulate-winged for 1–1.5 cm. at apex (lobes about 4 pairs, unequal, acute, 3–9 mm. long), then naked, at base abruptly dilated into connate lobate-dentate auricles about 1 cm. high; blades 10–12 cm. long, 7–11 cm. wide across the basal lobes, 5–9 cm. wide just above them, acuminate, shallowly cordate at base with wide-spreading acuminate basal lobes, rather evenly repand-dentate (teeth deltoid, mucronulate, 1–2 mm. high, 2–5 mm. apart), firm-papery, above deep green, beneath densely jointed-pilose with purplish hairs on veins and veinlets and sparsely so on surface, and thinly gray-arachnoid-tomentose (the tomentum obsolescent in age), strongly triplinerved from base;

heads 7 cm. wide, about 6–20 in loose terminal and axillary cymose panicles, the bracts small, the rather stout flexuous pedicels 4–9 cm. long; involucre broad, about 4-seriate, slightly graduate, jointed-pilose, the 2 or 3 outer series of phyllaries oblong-ovate or lance-oblong, acuminate, 2.8–4 mm. wide, substramineous, often purplish-margined and -tipped, weakly many-nerved, the innermost lance-linear, long-acuminate, 3–5-nerved, with rather loose obscurely greenish tips; receptacle deeply alveolate, the alveolar margins lacerate-ciliate, 3 mm. long; rays about 40, yellow, pilose on tube and back, the tube 4 mm. long, the lamina linear, 5-nerved, 3.2 cm. long, 2.2 mm. wide; disk corollas numerous, yellow, pilose on tube and sparsely on teeth, at apex of teeth pilose-barbate, 10 mm. long (tube 5 mm., throat 2 mm., teeth 3 mm.); immature achenes oblong, about 10-ribbed, sparsely hirsute, 1.6 mm. long; pappus brownish, of slender finely hispidulous graduate setae, not dilated at apex, the innermost bristles 9 mm. long, the outermost 2.5 mm.

PERU: "Beautiful liana, bright yellow," Muña, trail to Tambo de Vaca, Dept. Huánuco, alt. 2440 m., 5–7 June 1923, *Macbride* 4312 (type no. 535394, Field Mus.; dupl. no 1,191,493, U. S. Nat. Herb.).

Related to the Bolivian *L. pinnulosum* and *L. hirtum* Kuntze, but readily distinguished by its much larger involucre, in addition to other characters.

LIABUM RUSBYI Britton, Bull. Torrey Club **19**: 263. 1892.

In the original description the color of the flowers was not mentioned. In *Buchtien* 3032, described as a shrub 2 m. high, the "flowers" (probably the rays) are said to be violet, a color hitherto unrecorded in the genus.

Liabum hexagonum Blake, sp. nov.

Section *Munnozia;* "scandent shrub;" stem thinly arachnoid, strongly 6-angled; leaves elliptic or lance-elliptic, subentire, thin-coriaceous, glabrous and immersed-veined above, densely ochroleucous-tomentose with obscure venation beneath, the short barely margined petioles connate-auriculate at base; heads few, loosely cymose-panicled, long-pedicelled; outer phyllaries with spreading blunt tips.

Stem stout (6 mm. thick), hollow but firm, the angles ridged, the thin tomentum deciduous except from the deep grooves; main internodes 7–12 cm. long; leaves opposite; petioles scarcely margined, channelled, thinly arachnoid, abruptly widened at base into reniform or suborbicular entire connate auricles 4–7 mm. long; blades 9.5–15 cm. long, 2–3.8 cm. wide, acuminate, somewhat falcate, acutely cuneate at base, finely serrulate (teeth minute, subremote, mostly concealed by the slightly revolute margin), above deep green, reticulate-veined (the veins immersed), penninerved, the chief lateral veins about 12–15 pairs; heads about 2.8 cm. wide, about 9 in a terminal loose cymose panicle, the bracts small or minute, the pedicels 5–11 cm. long, thinly arachnoid and densely jointed-pilosulous; involucre hemispheric, about 4-seriate, graduate, 7–9 mm. high, the 2–3 outer series of phyllaries ovate-oblong or oval, about 3 mm. wide, with pale base and spreading rounded submembranous tips, thinly arachnoid outside, glabrous inside, the inner oblong, obtuse, the innermost lance-oblong, acuminate, thinly arachnoid and somewhat jointed-pilosulous; receptacle alveolate, the alveolar margins prolonged into triangular teeth 1 mm. long; rays 18 or more, yellow, the tube pilose, 4.5 mm. long, the lamina oblong, 4-nerved, 9 mm. long, 3.5 mm. wide; disk corollas yellow, 7.5 mm. long (tube pilosulous, 3.5–4 mm. long, throat campanulate, 0.8–1 mm. long, teeth 3 mm. long, clavate-glandular on back

and barbate-pilosulous at tip); young achenes about 10-ribbed, sparsely pilose; pappus brownish, graduate, of obscurely hispidulous bristles, not dilated apically, the inner 5 mm. long, the outermost 1 mm.

BOLIVIA: Unduavi, North Yungas, alt. 3300 m., Nov. 1910, *Buchtien* 3079 (type no. 43733, U. S. Nat. Herb.).

Nearest *Liabum rusbyi* Britton, and, like it, probably to be included in the section *Munnozia*. The strongly 6-angled stem, subentire leaves, and blunt spreading phyllaries characterize the species.

Liabum silphioides (Poepp.) Blake.

Prionolepis silphioides Poepp. Nov. Gen. & Sp. 3: 55. *pl. 261*. 1845.

Liabum affine Blake, sp. nov.

Section *Munnozia;* stem subterete, arachnoid-tomentose, glabrescent or glabrate; leaves large, oblong-ovate, crenate-dentate, soon glabrous above, densely tomentose beneath, feather-veined, subcoriaceous; heads few, large, short-rayed, on long pedicels; involucre 1.2 cm. high, of oval or oblong, broadly rounded, submembranous-tipped phyllaries; pappus as long as tube of disk corollas; flowers "yellowish green."

"Liana," the stout, weak, hollow stem herbaceous at least above, about 8 mm. thick; leaves opposite; petioles stout, broad, 3–8 cm. long, channelled, arachnoid-tomentose beneath, narrowly wing-margined above or throughout, abruptly dilated at base into connate denticulate auricles about 4 mm. high; blades of the larger leaves oblong-ovate, 17–21 cm. long, 6–8 cm. wide, acute, at base broadly rounded to cuneate-rounded, crenate-dentate (teeth about 1 mm. high, 3–6 mm. apart, usually appearing obtuse through the reflexing of the callous tip), above rather pale green, quickly glabrate except along the arachnoid costa, beneath densely and closely whitish- or somewhat ochro-leucous-tomentose, penninerved, the chief veins about 12 pairs, slender, scarcely prominulous above, evident beneath and with the secondaries reticulate; upper leaves much smaller (10 cm. long, 3.5 cm. wide), oblong, short-petioled; heads hemispheric, about 2.8 cm. wide in flower and fruit, about 1.5 cm. high, about 7 in a terminal simple cyme and also on 1–3-headed elongate peduncles from the upper axils, the bracts small or minute, the loosely spreading pedicels tomentose, 5–11 cm. long; involucre about 4-seriate, graduate, appressed, the phyllaries oval, oblong, or slightly obovate-oblong, 4–5 mm. wide, glabrous, with substramineous base and shorter to subequal, submembranous, about 11-nerved, broadly rounded tip; receptacle alveolate, the alveolar margins submembranous, lacerate-ciliate, 5 mm. long; rays numerous, bilabiate, long-pilose on tube and back, the tube 4 mm. long, the inner lip linear-acuminate, nerveless, 8 mm. long, the outer bifid to below the middle, 12 mm. long, the lobes unequal in breadth, 2–4-nerved, densely barbate outside below apex (hairs slender-clavate, their cells 2-seriate); disk corollas numerous, 12.5 mm. long (tube very sparsely pilosulous or essentially glabrous, 6.5 mm. long, throat slender-campanulate, 2.2 mm. long, teeth 3.8 mm. long, clavate-glandular on back above, below apex densely barbate with hairs like those of the ray corollas); achenes nearly oblong, brownish, 10-ribbed, 2 mm. long, bearing a very few hairs near tip; pappus brownish, the bristles slender, not dilated at apex, obscurely hispidulous, graduate, the inner 9 mm. long, the outer about 4 mm. long, all fragile and readily deciduous from the very shallow saucer formed by their connate bases.

PERU: "Liana, flowers yellowish green," Muña, trail to Tambo de Vaca, Dept. Huánuco, alt. 2440 m., 5–7 June 1923, *Macbride* 4337 (type no. 535421, Field Mus.; dupl. no. 1,191,497, U. S. Nat. Herb.).

This interesting plant is evidently very closely allied to *L. silphioides* (Poepp.) Blake, but differs in so many details that it seems best to describe it as a new species. *Liabum silphioides* was described as a 3-foot herb with 4-angled stem, proportionately broader and membranous leaves (the lower subcordate), golden flowers, and pappus about half as long as the tube of the disk corollas. The rays of *L. affine*, as described above, suggest those of the Mutisieae, but they are probably abnormal; at any rate those of *L. silphioides*, certainly a very closely related plant, are not so described.

Liabum stenolepis Blake, sp. nov.

Section *Erato*; stem, petioles, and pedicels spreading-hirsute; leaves broadly cordate-ovate, coarsely repand-dentate, slender-petioled; heads numerous, cymose-panicled, long-pedicelled, comparatively large; involucre 12–13 mm. high, the outer phyllaries narrowly lance-triangular, acuminate, with long hispidulous herbaceous tips, the innermost elongate-linear, less than 1 mm. wide.

"Liana;" stem stout (6 mm. thick), pithy, obtusely 6-angled, densely spreading-hirsute with tuberculate-based hairs, glabrescent below; leaves opposite; petioles 4–7 cm. long, naked except at base where bearing oblong herbaceous connate auricles 1 cm. long; blades about 12 cm. long, 8–11 cm. wide, acuminate, shallowly cordate at base, coarsely repand-dentate (teeth about 4–7 pairs, deltoid, acute, up to 1 cm. high) and remotely callous-denticulate, submembranous, above deep green, beneath somewhat paler, rather densely strigose on both sides and along the veins spreading-hirsute, palmately 7–9-nerved from base; panicle ternately divided, about 25 cm. long and wide, about 24–35-headed, pubescent like the stem, the pedicels mostly 2.5–5 cm. long, the bracts small, subulate; disk in fruit 1.8–2.2 cm. wide; involucre broad, about 6-seriate, graduate, the 3–4 outer series of phyllaries elongate-triangular (about 1.5 mm. wide), with short, substramineous, sparsely hispidulous base and much longer, loose, acuminate, callous-pointed, herbaceous tips, these hispidulous on both surfaces and ciliolate, the 2 innermost series of narrowly linear, obtuse or acute, 3–5-nerved, substramineous phyllaries (about 0.6 mm. wide), ciliolate, essentially glabrous dorsally; receptacle areolate, glabrous; rays (only immature ones examined) numerous, glabrous, the tube 1.5 mm. long, the lamina linear, 6 mm. long, 0.6 mm. wide, 3-nerved, obscurely bidenticulate; disk flowers numerous, their corollas (immature) hirsute at base of throat, hispidulous at tip of teeth, 6.7 mm. long (tube 2.6 mm., throat 1.4 mm., teeth 2.7 mm.); achenes oblong, 1.5 mm. long, strongly 3 (ray) or 4 (disk)-ribbed, whitish, glabrous or rarely very sparsely hispidulous above; pappus brownish-white, 6 mm. long, of numerous nearly smooth somewhat flattened setae, and a few short similar but more slender outer ones about 1 mm. long.

PERU: "Liana, flowers lemon-yellow," Muña, trail to Tambo de Vaca, Dept. Huánuco, alt. 2440 m., 5–7 June 1923, *Macbride* 4338 (type no. 535422, Field Mus.; dupl. no. 1,191,498, U. S. Nat. Herb.).

Allied to *L. vulcanicum* Klatt and *L. pallatangense* Hieron., but with considerably longer involucre, the outer phyllaries narrowly linear-lanceolate and

rather densely hispidulous dorsally, the inner elongate-linear. The type of *Erato polymnioides* DC., examined by the writer in 1925, is the same species as *L. pallatangense* Hieron. De Candolle's name is not available because of the use of the name *Liabum polymnioides* by R. E. Fries in 1907 for an Argentinian species.

Liabum tenerum (Sch. Bip.) Blake.

Kastnera tenera Sch. Bip. Flora **37**: 38. 1853.

COLOMBIA: Cliffs at cascade, La Lora to summit, new Quindio trail, Cordillera Central, Dept. Tolima, 14 Aug. 1922, *Killip* 9775.

Mr. Killip's plant agrees so closely with Schultz's careful original description as to leave no doubt of its identity. The type was collected in the same general region ("prov. Cauca pr. Quindiu Paramilla alt. 10,500 ped. Februario 1843: Linden! n. 1136"), and probably, according to information received from Dr. F. W. Pennell, within 10 miles of the spot where Killip collected the species. *Liabum niveum* Hieron. is very closely allied, having the same involucre and pappus, but is apparently distinct in its arachnoid-tomentose peduncles and young growth and in the dense white tomentum of the lower leaf surface.

LIABUM HYPOLEUCUM (DC.) Blake, Proc. Biol. Soc. Washington **39**: 144. 1926. *Vernonia hypoleuca* DC. Prodr. **5**: 27. 1836.

When transferring this species to *Liabum*, I suggested that it was probably a Peruvian species, although originally described as collected in Mexico by Haenke. Its characters are in the main those of the *L. glabrum* group of Mexico, not those of any South American group, and it now seems probable that the habitat originally recorded was correct.

PALEOBOTANY.—*Cycads in the Shinarump conglomerate of southern Utah.*[1] EDWARD W. BERRY, Johns Hopkins University. (Communicated by J. B. REESIDE, JR.)

The rarity of fossil plants in the Triassic formations of the western United States is my excuse for the following note. In 1921 R. C. Moore made a small collection of plants from the Shinarump conglomerate at a locality 3½ miles east of Wagon Box Mesa and 2 miles east of Water Pocket Canyon in eastern Garfield County, southern Utah. The plants are contained in a brown sandstone or sandy clay-ironstone, and the bulk of the material, including all that is determinable, appertains to a single species.

The collection was reported upon by F. H. Knowlton in a letter dated Oct. 14, 1922, and was said to represent *Otozamites macombii*

[1] Published by permission of the Director, U. S. Geological Survey. Received April 25, 1927.

Newberry, and *Equisetum* or *Schizoneura* sp. A careful study does not corroborate these tentative determinations. Before describing this material it may be useful to refer to the status of older Mesozoic floras in this general region.

In 1876 Newberry published a description of 14 species of fossil plants in his account as geologist of the Macomb expedition to New Mexico. Of these, *Otozamites macombii* and *Zamites occidentalis* came from the old copper mines near Abiquiu and the balance from the State of Sonora, Mexico. In 1886 Major Powell made a second small collection near Abiquiu, and in 1889 Knowlton made a third collection. These two collections were described in 1890 by Fontaine & Knowlton,[2] who recorded the following additional species: *Equisetum abiquiense* Fontaine, *Equisetum knowltoni* Fontaine, *Zamites powelli* Fontaine, *Cheirolepis münsteri* Schimper, *Palissya brauni* Endlicher (?), *Palissya* cone (?), *Cycadites* (?), *Ctenophyllum* (?), and *Araucarioxylon arizonicum* Knowlton. Ward visited the region in 1899 and 1901 and prepared an elaborate geological report,[3] but added nothing to the paleobotany but the name *Araucarites chiquito* for an obscure cone (?) which has never been described nor figured.

Ward recognized in what he called Powell's "Shinarump formation" two fancied members—the "Leroux beds" above, which includes the so-called "Belodont beds," of Upper Triassic age and referable to the Chinle formation; and a lower, called at first "Shinarump conglomerate" and later the "Lithodendron member," which, he believed, contained all of the abundant petrified wood of the region, and which includes Shinarump conglomerate in the strict sense and a part of the Chinle formation.

Gregory, who carried out extensive field work in the Navajo Country from 1909 to 1913, the results of which are recorded in U. S. Geological Survey Professional Paper 93 (1917), not only summarized the history of exploration of the region, but gave reasons for dropping Ward's terminology and restricting the Shinarump conglomerate to the sense in which it was proposed by Powell.

It seems remarkable that in a region noted for the abundance of silicified wood, some of it in place where it grew, so few traces of foliar parts should be found, especially since all of the wood examined microscopically is coniferous, and coniferous foliage is usually the last type of vegetation to disappear under all conditions of sedimentation.

[2] W. M. Fontaine and F. H. Knowlton. *Notes on Triassic plants from New Mexico.* Proc. U. S. Nat. Mus., **13**: 281–285. *Pls. 22–26.* 1890.

[3] L. F. Ward. U. S. Geol. Surv., 20th Ann. Rept. (2): 315–334. 1900.

My impression is that vast quantities of foliar remains have been entombed, but these have become so oxidized as to have practically disappeared, except locally. I know that in the so-called "Popo Agie beds" of Wyoming, of approximately the same age as the Shinarump, fossil plants are common, but usually so near the vanishing point as to be generally unrecognizable.[4]

Turning now to the plants collected from the Shinarump conglomerate of southern Utah by Mr. Moore, the supposed *Equisetum* or *Schizoneura* is represented by fragments of longitudinally ridged objects, sometimes preserved for lengths of 9 centimeters without showing any nodes. If these fragments represent arthrophytes they could hardly be *Equisetum* since the vascular bundles in that genus normally alternate at the nodes. The genus *Schizoneura* normally has bundles continuous from internode to internode, but in the case of these Shinarump fragments the ridges are not parallel and I therefore conclude that they almost certainly represent fragments of some large-pinnuled cycad.

The abundant and definitive plants from this locality are identical with what Fontaine called *Zamites powelli* from Abiquiu, but since they are not referable to *Zamites* and also were never adequately described, they may be characterized as follows:

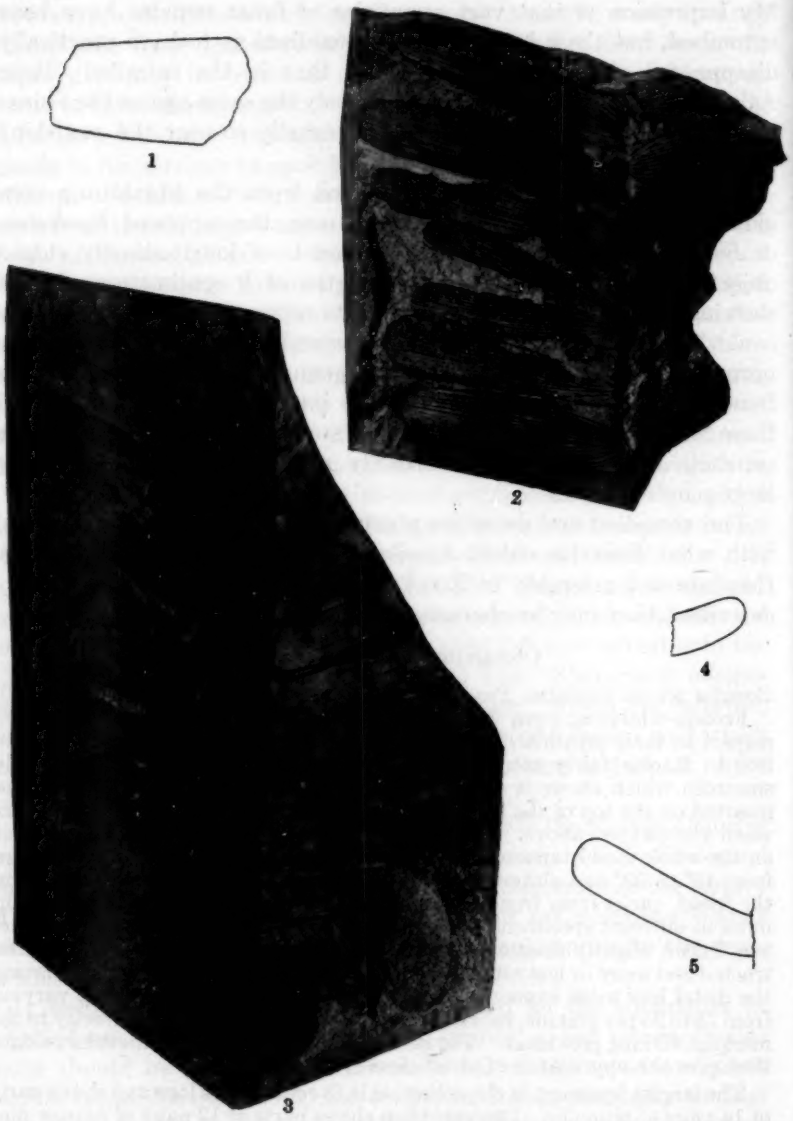
Otozamites powelli (Fontaine)

Zamites powelli Fontaine, Proc. U. S. Nat. Mus. **13**: 284, *Pls. 25, 26*. 1890.

Fronds exhibiting great variation in the size of the pinnules, not only with respect to their proximal, median or distal positions, but also from frond to frond. Rachis fairly stout, about 2 millimeters in diameter in the only specimen which shows it clearly, slightly flexuous and striated. Pinnules inserted on the top of the rachis, which consequently appears unduly slender when viewed from above. The pinnules are alternate, variously spaced, but on the whole closely spaced; their angle of divergence from the rachis varies from 45° to 90° and although partly explained according to their position in the frond, varies from frond to frond. This is shown by the same sized pinnules in different specimens showing a similar variability. Pinnules coriaceous, linear, slightly falcate, truncately rounded at their tips; the base contracted and more or less retuse, generally equilateral, but occasionally having the distal half more expanded than the proximal half. Veins thin, varying from 15 to 25 per pinnule, radiating from the area of attachment directly to the margins, forking proximad. The lamina between the veins forms raised ridges that give the appearance of stout close-set veins.

The largest fragment in the collection is 13 centimeters long and shows parts of 14 pairs of pinnules. One specimen shows parts of 12 pairs of narrow pinnules 5 millmeters wide, and immediately beside it are fragments of 5 regularly oriented pinnules 12 millimeters wide. One small fragment shows

[4] E. W. BERRY. Journ. Geol., **32**: 488–497. 1924.



Figs. 1–5. *Otozamites powelli* (Fontaine).—1, fragment showing the maximum observed width of pinnules; 2, 3, showing character of the material and general form, with insertion and venation of the pinnules; 4, outline of a basal pinnule (except base); 5, outline of a normal pinnule (except base).

pinnules (presumably distal) between 2 and 2.5 millimeters wide, and other characteristically veined fragments have widths of 1.5 centimeters. In some specimens the pinnules are preserved with their margins incurved as though buried while dry by wind blown sediments.

Otozamites powelli differs from *Otozamites macombii* in the more regular alternate arrangement of the pinnules, those of the two sides inserted closer together on top of the rachis, which is more slender, and in the shape and relative proportions of the pinnules. In Newberry's species they are twice as wide, and range in form from orbicular or reniform to oblong. There is no doubt that a single botanic species might readily show an equal amount of foliar variation, but in the absence of association or intergradation the two must be considered distinct species.

There are various foreign species of *Otozamites*, both in Europe and Asia which resemble the present fossil, mostly from beds believed to be Rhaetic in age, but such long distance comparisons have but slight significance. The only American form which is similar is the variety *intermedius* of *Otozamites hespera* Wieland from the supposed Lias of Oaxaca, southern Mexico.

The problem of the generic limits in fossil cycad fronds is a difficult one, about which students have decided differences of opinion, and this is especially acute as between *Zamites* and *Otozamites*, the former originally including the latter, which was proposed as a sub-genus of *Zamites* by Braun in 1842. The only recent systematic work which discusses this generic difficulty is that of Halle (The Mesozoic Flora of Graham Land, 1913). He restricts *Otozamites* to forms with an asymmetric, auriculate base, the distal lobe more prominently developed than the proximal. Thus defined his *Zamites* includes forms which I would refer to *Otozamites*.

Venation, although dependent to a considerable extent upon form, should not be ignored. Naturally the longer and narrower the pinnules, the more nearly will the veins approach parallelism, and in any genus with a contracted area of attachment the veins will converge within such limits, but in *Zamites* none of the veins flare directly to the lower margins as they do in *Otozamites*. The auriculation of the base, as the present species shows, may be present or absent among the pinnules of a single frond.

SCIENTIFIC NOTES AND NEWS

The Pick and Hammer Club met at the Geological Survey on April 30. Professor WALTER H. BUCHER of the University of Cincinnati spoke on the subject of *Continental tectonics*.

The annual field meeting of the Petrologists' Club was held on May 7 in the vicinity of Baltimore, with Prof. J. T. Singewald of Johns Hopkins University as guide.

RESOLUTIONS

The following resolutions on the death of Charles Doolittle Wolcott were adopted by the ACADEMY:

Whereas: there has passed from us one friendly in spirit, wise in counsel, highly eminent in attainments in his chosen fields of geology and paleontology, honored by many universities and learned societies of the world, who in his long life had filled with distinction several of the highest scientific offices of the United States:

Resolved: that the Washington Academy of Sciences hereby records its profound sense of the loss occasioned by the death of its member and former president, CHARLES DOOLITTLE WALCOTT, and its sympathy for his family.

Resolved: that this resolution be spread upon the minutes of the Academy and copies be transmitted to the family and to the Smithsonian Institution.